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Rachel Levy, Jean-Pierre del Corso, François Fall

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French Agricultural Education Students: “Intermediaries” in the Fight against Climate Change?

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**Title: French Agricultural Education Students: “Intermediaries” in the Fight against
Climate Change?**

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Authors : LEVY Rachel^a; DEL CORSO Jean-Pierre^b (LEREPS, ENSFEA, Université de
Toulouse), 2 Rte de Narbonne, 31320 Castanet-Tolosan) and FALL François Seck^c (LEREPS,
Université Jean Jaurès, Université de Toulouse)

a : rachel.levy@ensfea.fr

b : jean-pierre.del-corso@ensfea.fr,

c : francois.fall@univ-tlse2.fr

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Abstract: This article aims to better understand how students of French agricultural education position themselves in the face of climate change and get involved in its fight. It is based on a survey carried with 300 students enrolled in the Brevet des Techniciens Supérieurs Agricoles class. A statistical analysis highlights the sensitivity of students to climate change. Then, an econometric modeling examines the determinants of this sensibility. Finally, a qualitative study based on semi-directive interviews makes it possible to characterize the role of students as intermediaries of knowledge and innovative practices. First, the results shown the a priori paradoxical place of digital culture. Indeed, social media plays a negligible role in restructuring students' beliefs. However, agricultural school is a space for interactive discussions in which opinions on climate change are formed and transformed. Our results also show that territories specifically in rural areas, appear as spaces for innovation because it is potentially the source of new rules and norms of behaviour. This study serves more particularly to examine in what way and how the presence of these students in three contrasting cultural spaces (the social networks, the School and the territories of life) shape their beliefs on the subject and endow them with a power to act.

1. Introduction

There is now many evidences that the climate system is warming, and that human activities, mainly through greenhouse gas emissions, bear a heavy responsibility for this warming. In its latest report, the Intergovernmental Panel on Climate Change (IPCC, 2023) notes an increase in extreme weather and climate events in all regions of the world. The report's authors conclude that only rapid and far-reaching transitions in all sectors and systems can mitigate climate disruption and ensure a liveable and sustainable future for all (IPCC, 2023).

This climate crisis particularly affects the youngest members of the population and alters their rights (Rees, 2021). Indeed, uncontrolled global warming exposes future generations to major

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3 and growing risks in terms of food security, drinking water availability, health, housing and the
4
5 preservation of natural ecosystems (Sanson and Burke, 2020). As a corollary, this situation
6
7 affects the mental well-being of the young population and is accompanied by high levels of
8
9 climate anxiety (Hickman et al. 2021). The resulting sense of anger at perceived government
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11 inaction is encouraging some young people to get involved in the fight against climate change
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13 (O'Brien et al., 2018; Hickman et al., *ibid.*; World Health Organization, 2021). "The global
14
15 climate strike movement" inaugurated in 2018 by Greta Thunberg was, from this point of view,
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17 a precursor.
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21 Against this backdrop of youth mobilization, international organizations (United Nations, 2023;
22
23 UNICEF, 2023; UNESCO, 2023) are increasingly recognizing the role that young people have
24
25 to play in the fight against climate change. In addition to being citizens in their own right, this
26
27 social group includes the future leaders of tomorrow and those who will have to manage the
28
29 problems resulting from climate disruption (Ojala et al., 2017). Aware of this, these
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31 international organizations are taking initiatives within their ranks to take greater account of
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33 young people's voices on this issue by involving them in working groups.
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38 To support youth climate movements, a deeper understanding of how this segment of the
39
40 population forms its opinions on climate change, engages in its struggle and manages to develop
41
42 the power to act is necessary. This knowledge is crucial to encourage this population as a whole
43
44 to adopt pro-environmental behaviors, and thereby foster a transition towards more sustainable
45
46 socio-economic development models. In recent years, work by authors such as Corner et al.
47
48 (2015), centred their research on the key determinants of effective climate change
49
50 communication targeting young people. Their research highlights the importance of messages
51
52 that promote positive values and that are associated with the adoption of pro-environmental
53
54 behaviour. It also highlights the influence of information from sources that young people
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56 consider trustworthy, such as the scientific community, teachers, parents, and peer interactions.
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3 More recently, Lee et al. (2020) examined the perceptions of climate change among 8 to 19-
4 year-olds, their understanding of the phenomena at stake, and the validity of the knowledge
5 they have. These authors show that while scientifically accurate knowledge generally increases
6 with age, belief levels and willingness to act vary substantially across age and world regions.
7
8 Han et al. (2020) analysed the role of youth as change agents. These authors focus in particular
9 on young people's power to act and their ability to influence public policies towards a better
10 response to the climate emergency. A number of studies have focused specifically on the
11 environmental activism of certain young leaders (Cloughton, 2021). Thus, Buttigieg et al.
12 (2013) aim to identify the reasons for the commitment of these young leaders with a view to
13 drawing lessons for designing environmental education and promoting pro-environmental
14 behaviors among the young population. O'Brien et al. (2018) focus on distinguishing different
15 types of activism and assessing their ability to challenge power relations in order to promote a
16 future resilient to climate change. Unfortunately, very little of this literature addresses the
17 sources from which young people derive their knowledge about climate change, and how these
18 sources influence their beliefs and behavior.
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37 To elaborate further on this literature, this article has two main objectives. First, it aims to more
38 specifically identify the sources from which young people draw their knowledge about climate
39 change and how these sources influence their beliefs and behaviour. It then aims to analyse how
40 young people themselves contribute to the spread of this knowledge. Achieving this dual
41 objective should make it possible to identify the main agents for training and transforming
42 young people's preferences on the issue of climate change. To our knowledge, this article is
43 one of the first studies to analyse the sources of young people's knowledge about climate
44 change and to examine their impact on the behaviour of these young adults, particularly in the
45 French context.
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3 From a theoretical perspective, this research is based on contributions from institutional
4 economics (North, 2005; Denzau and North, 1994) and historical-cultural psychology (Cole,
5 1996; Bruner, 1996). The interest of some of this literature is to consider that cognition is not
6 so much an individual process as a reflection of inclusion in a particular culture. In this article,
7 the way in which young people belong to three contrasting cultural spaces - social media, school
8 and territories of life - will be considered an essential key to accessing and understanding how
9 they think about climate change and how they rationalise actions to combat its effects. By
10 drawing on research into innovation intermediaries (Howells, 2006) and territorial
11 intermediaries (Bourdin and Nadou, 2020), the authors also examine how young people
12 perform comparable roles within these three spaces, thereby helping to sustain the process of
13 actualising beliefs about climate change.

14
15 From a methodological standpoint, this research is based on an online survey followed by semi-
16 structured interviews with young adults enrolled in agricultural schools in France in Advanced
17 Agricultural Technician Diploma (AATD) courses. These young people are characteristically
18 preparing to take up employment in business sectors that are heavily affected by the issue of
19 climate change. production and processing trades, farming, and occupations involving the
20 management and protection of nature. The results of the online survey are used first to access
21 students' beliefs and practices on climate change, and then to determine the correlate factors
22 for these beliefs and practices using econometric models. Semi-structured interviews are then
23 used in an analysis drawing to reveal the how students access and disseminates knowledge
24 about climate change. This result allows to more accurately characterise the role of AATD
25 students as intermediaries.

26
27 The rest of the article is organised in four sections. First, the paper outlines the theoretical
28 frameworks used. Then, a description of the field of study is proposed, the type of data collected
29 and the method. Next, the fourth section is dedicated to present the results obtained from the

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3 statistical, econometric and quantified narrative analyses carried out. Lastly, discussions of the
4
5 results allow to provide some brief closing remarks.
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10 **2. Literature Review**

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12 This literature review focuses on two types of contributions: the ones from institutional
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14 economics and historical-cultural psychology, and those from the field of innovation economics
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16 and territorial economics on intermediaries.
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21 **2.1. Inclusion in a culture: a key to understanding ways of thinking**

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23 The authors use an institutionalist and psycho-cultural grid to analyse how individuals acquire
24
25 beliefs about climate change and examine the ways in which their judgements can be shaped.
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27 This literature emphasises the socio-cultural and institutional anchoring of cognition. In the
28
29 field of institutional economics, Commons (1934) argues that since humans live as a society,
30
31 thought habits are formed in the context of social interactions. Later, Denzau and North (1994)
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33 argue that individuals' mental models derive from their cultural heritage. These authors
34
35 consider that culture determines the nature of individual and collective learning. This "*cultural*
36
37 *learning*" (Denzau and North, 1994) provides individuals with different forms of knowledge
38
39 (scientific or non-scientific in origin: myths, dogmas, taboos, etc.) to classify their experiences.
40
41 Fundamentally, North (2005) infers that cultural resources make it possible (or not) for humans
42
43 to adapt to changes in their physical and social environments. Institutions themselves provide
44
45 two essential cognitive resources: rules and ideologies (Denzau and North, 1994). In particular,
46
47 this diversity is said to support creativity and the transfer of experiences in a society and thereby
48
49 stimulate a process of institutional change which comes with an actualisation of the ways of
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51 thinking and acting. It is rooted in a transformation of the cognitive rules, norms and patterns
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3 from which individuals rationalise their actions. Accordingly, North is entitled to argue that
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5 while the culture of a society determines its present, it also influences its future (North, 2005).
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8 Authors in historical-cultural psychology develop comparable ideas. Cole (1996; 2003) thus
9
10 highlights that thinking has a public dimension insofar as mindsets are modelled by culture.
11
12 This shapes the human mindset according to Bruner (1996). Moreover, one of the interests of
13
14 these authors' contributions is to explain the dynamic relationship between culture and
15
16 institutions. Roy d'Andrade (2003) thus specifies that it is through institutions that the process
17
18 of legitimation of cultural meanings is carried out. They then acquire the status of shared
19
20 cultural patterns and will assert themselves as collective beliefs (d'Andrade, 2003). Indeed,
21
22 based on a social agreement, institutions have the capacity to impose certain behaviour patterns
23
24 and, therefore, to determine types of roles for actors and socially-conceivable modes of action.
25
26 As a result, the dialectical movement between culture (what is possible) and institutions (what
27
28 is canonical) determines the capacity of the members of a society to actualise their ways of
29
30 thinking and acting (Bruner, 1986).
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35 In economics, part of the literature on climate adaptation is based on an analysis of institutional
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37 phenomena (see, for example, Bisaro et al., 2018; Sattler et al., 2023). Bisaro et al. (2018)
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39 highlight that this analysis proves very useful for exploring the role of relations of power,
40
41 resource allocation and knowledge in climate vulnerability, for considering the cognitive
42
43 dimension of climate adaptation and considering the capacity of collective action to adapt to
44
45 climate change. In cognitive-cultural psychology, several authors (for example, Newman et al.,
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47 2018) show how the opinions expressed by individuals on climate change reflect their cultural
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49 way of life.
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3 At the crossroads of these two fields of research, the present study focused on youth, is
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5 concerned with the cultural and institutional dynamics in three distinctly functioning spaces:
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7 school, social media and territories¹.
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10 First, as highlighted by Corner et al. (2015), school is a determinant of young people's
11
12 involvement in the fight against climate change. For their part, Wuepper et al. (2019) were able
13
14 to show that education promotes criticality and reflectivity about daily practices. In essence,
15
16 Bruner (1996) emphasises that education is a main entry into a culture and school has a key role
17
18 to play in this. In particular, this author advocates that school not only be a place in which
19
20 academic knowledge is conveyed but also a place in which students learn to negotiate with a
21
22 culture. He therefore advocates the use of pedagogical methods (project-based and/or
23
24 investigative approaches) designed to place pupils in a reflective posture with regard to
25
26 knowledge that is considered valid and to encourage them to imagine other possible worlds. In
27
28 this sense, this activity of negotiating/re negotiating a culture that is fostered at school can be
29
30 likened to a form of "*institutional activity*" (Berger and Luckmann, 1966) that feeds a process
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32 of constructing/reconstructing social reality.
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37 Second, social media have become major channels for spreading information and knowledge
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39 and their influence on the formation of young people's ways of thinking is undeniable. Cotterell
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41 (2007) and Robelia et al. (2011) thus show that social media contribute to significantly
42
43 improving young people's knowledge of climate change and stimulating their involvement in
44
45 combating its effects. The works of Boulianne et al. (2020) achieve similar results. The authors
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47 point out that digital media facilitate information sharing about climate change and empower
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49 young people to act. Discussions on social media are thus likely to contribute to restructuring
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51 young people's ways of thinking by supporting a dialectic between culture and institutions: the
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53 spread of new knowledge can fuel demands for better consideration of the fight against climate
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59 ¹ The potential role of other knowledge-producing places, such as the family circle, television, radio or newspapers
60 is not overlooked in this article.

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3 change in public policies. Moreover, this means of discussion via social media is heavily relied
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5 upon in the agricultural sector (Mailfert, 2007).
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8 Lastly, the fact that young people live in one or several territories is also likely to influence
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10 their motives and their power to act. Indeed, territories are spaces in which multiple actors
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12 coordinate around diversified resources (Colletis-Wahl and Pecqueur, 2001). Current
13
14 environmental challenges are pushing actors to reassess local cultural knowledge and
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16 prompting them to invent new modes of governance of shared environmental resources
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18 (Talandier and Dondimoni, 2022). In this respect, the territory also appears as a setting in which
19
20 important cultural and institutional dynamics take place.
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24 Accordingly, we posit that belonging to these three cultural spaces, which function differently
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26 but which are all intended to support an activity of negotiating/renegotiating the meanings of
27
28 the world, is apt to confer a particular role on young people in the spread of knowledge about
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30 climate change. The concept of “*intermediary*” is used to better characterise this role.
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34 35 **2.2. The role of intermediaries in knowledge transfer**

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37 The concept of intermediary was initially used in the literature relating to the economics of
38
39 innovation and knowledge to better describe the mechanisms of knowledge transfers,
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41 particularly between science and industry. Brown and Duguid (1998) were the first to make
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43 reference to communities articulators. These authors examined the role played by individuals
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45 members of several communities. These individuals help to translate the perspectives or
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47 knowledge held within one community into the language of another one. More broadly, the
48
49 concept of innovation intermediary was defined by Howells (2006) who distinguishes between
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51 intermediaries as organisations and intermediaries as roles and particular by facilitating
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53 innovation process (Klerkx and Leuwis, 2009). Methodological developments in social media
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55 analysis and particularly research on centralities of intermediarity and on intermediaries
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referred to as “*brokerage*” have also allowed for a deeper analysis of the role of these innovation intermediaries (Lechner and Leyronas, 2012; Levy and Talbot, 2015). This concept of intermediary as also been used in rural studies to look for the particular role of rural social enterprises (Richter, 2019).

Several authors in territorial economics have also recently introduced the concept of territorial intermediary (Bourdin and Nadou, 2020). These authors show how, in the territories, some actors operate as facilitators of local development projects (i.e., intermediaries), connecting stakeholders to it, stimulating their communication, contributing to the dissemination of information and the implementation of support mechanisms for such projects.

Here this literature is mobilized to examine the extent to which young people trained through agricultural education can be intermediaries in the dissemination of knowledge and innovative practices relating to the fight against climate change, and more broadly how agricultural education can be seen as an institutional mechanism for territorial intermediation.

3. Data and Methods

3.1. Object of study: French agricultural education

Agricultural education and its audiences are the focus of the study conducted here (Cardi, 2004). This choice is justified for two reasons. First, it provides training in trades relating to natural and life sciences. Accordingly, in the context of their future professional activity, the graduates of this training programme will be called upon to interact directly with the natural environment and to influence its evolution. Through this audience, the aim is to examine more closely how young actors, who are already in touch with professional realities, be it in the production and processing trades or in the development and protection of natural resources, position themselves in relation to global environmental changes such as global warming. Second, agricultural schools are solidly anchored in the territories and form close partnerships with the various actors

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3 present therein. As a result of their missions and of this anchorage, these schools very often
4 appear as legitimate spaces for the coordination of multiple actors. The aim is therefore to
5 identify more specifically their potential role as intermediaries in the production and spread of
6 knowledge about climate change.
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12 The survey protocol more specifically targets students in their first and second years of the
13 AATD, and who are therefore potentially on the verge of employment in the agricultural and
14 rural sector. The survey was conducted among students in training programmes with contrasting
15 objectives: AATDs focusing on agricultural production and processing trades such as AATD
16 Business Analysis, Conduct and Strategy and AATD Food Science and Techniques, and
17 AATDs focusing more on nature management and protection trades such as AATD Nature
18 Management and Protection, AATD Water Management or the management of living resources
19 such as AATD Agricultural, Biological and Biotechnological Analysis. In all, the survey
20 involved 16 agricultural trade school classes located in rural, peri-urban and urban territories of
21 the greater south-western and south-eastern regions of France. p
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38 **3.2 Data collection instrument**

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40 Initially, an online survey was conducted in sixteen classes². The purpose of this survey was to
41 assess the awareness of this group of students to climate change and to identify the practices
42 adopted to address it, this group's sources of information and knowledge about this issue, and
43 the students' potential role in the dissemination of this information and knowledge. In all, the
44 online survey involved nearly 300 students with a response rate of 66%. Table 1 provides details
45 about the survey group.
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59 ² An in-class survey had been foreseen between February and April 2020. The COVID crisis hence the choice of
60 an online survey.

Table 1: Description of the survey group

Location of the secondary school	Agricultural production programme		Management and protection of nature programme		Other programmes		Overall total	
	number replies	number surveyed	number replies	number surveyed	number replies	number surveyed	number replies	number surveyed
Secondary school in rural territory	17	23	39	66	11	16	67	105
Secondary school in peri-urban territory	19	26	44	58	0	0	63	84
Secondary school in urban territory	39	68	18	32	7	7	64	107
Overall total	75	117	101	156	18	23	194	296

Source :authors

The survey was supplemented in May and June 2020 by twelve semi-structured interviews conducted by telephone with students who had already filled in the online questionnaire and who have accepted to answer to an interview. The interview grid was developed from this questionnaire. The students interviewed were asked to give a reasoned explanation for each of their initial replies to this same questionnaire. The purpose of these interviews, which averaged about 45 minutes in length, was to gain more detailed information about the reasons for particular climate change beliefs and to better understand the role that students play in disseminating information about climate change.

3.3. Data analysis technique

These data were first processed statistically, then by means of three econometric models. First, a binary logit model was estimated to see, the role of different socio-economic variables

(gender, socio-professional origin, training programme followed, spatial location of the school facility), and the role of the sources of information used on the students' level of awareness of climate change. Control variables on the trust placed in each of these sources were also incorporated. Then, a linear regression model was used to determine the impact of these same variables on the number of practices students were willing to revise. Lastly, a third linear regression model was estimated to analyse the effect of the student's perception of climate change in revising practices. This latter model seeks to verify whether or not a perception of change translates into a revision of climate-related practices. These models are estimated considering the self-correlation problems of heteroscedasticity errors.

Concerning the interviews, there were first fully transcribed. We then used these transcripts to pinpoint the students' initiation of relationships to access informational resources and/or disseminate information about climate change. Drawing on the work of Grossetti and Bes (2000), we then traced these relationships in simplified diagrams.

4. Results

4.1. Climate change awareness, involvement and knowledge sources

To measure the level of the students' beliefs about climate change, students are asked to rate the importance they attach to climate change. Our results show that they are on the whole very aware of the issue of climate change: 85% of them give it a score of between 4 and 5.

Table 2: Importance placed on climate change

Importance placed on climate change	Number of students	%
1-not important	1	0%
2-moderately important	3	2%

3-important	25	13%
4-quite important	63	32%
5-very important	102	53%

Source: Authors

Students are also interrogating to identify the habits they would be willing to reconsider in order to adapt to climate change. From this perspective, the findings reveal that the students' concerns about climate change are reflected in their everyday social practices. While 3% of them said they were reluctant to change any of their practices, 42% of them said they were ready to change three or more than three daily practices, particularly by changing their eating habits (54%) or by using public transport (58%).

Lastly, youth are asked about their sources of information and trust according to each one of these sources. Social media and teachers were mentioned most regularly even the trust on this source is inferior to the other sources of knowledge. To a lesser extent, family members, newspapers and television were also mentioned. Other sources of information, such as peer-to-peer relationships in the classroom, radio, influencers, and politicians, seemed to play only a minor role.

Table 3: Student information sources and positioning with regard to these sources

Knowledge source	Extent to which this knowledge source is used	Total	%	Number of students according trust in the knowledge sources (%)
Social media	0-never or 1-rarely	26	13%	78 (40%)
	2-sometimes	31	16%	
	3-often or 4 -all the time	137	71%	
Teachers	0/1	32	17%	185 (95%)
	2	48	25%	
	3/4	114	58%	
Family and	0/1	34	18%	167

friends	2	74	38%	(86%)
	3/4	86	44%	
Newspapers	0/1	47	24%	170 (88%)
	2	64	33%	
	3/4	83	43%	
TV	0/1	48	25%	126 (65%)
	2	62	32%	
	3/4	84	43%	
Class	0/1	55	28%	162 (83%)
	2	67	35%	
	3/4	72	37%	
Influencers	0/1	118	61%	125 (64%)
	2	48	25%	
	3/4	28	14%	
Radio	0/1	104	54%	147 (76%)
	2	63	32%	
	3	27	14%	
Politicians	0/1	122	63%	77 (40%)
	2	57	29%	
	3/4	25	13%	
Total		194	100%	

Source: Authors

Quantitative analyses are used to verify the robustness of these initial results and to investigate them further.

4.2. Determinants of climate change awareness and of revised practices

Table 4 shows the results of the models that were estimated to determine the link of socio-economic characteristics and information sources on the degree of climate change awareness.

Table 4: Factors explaining climate change awareness and revised practices

Variables		Model 1	Model 2	Model 2
	Number of habits changed (0-5)		Variable explained	Variable explained
	Importance placed on climate change	Variable explained		0.493** (0.205)
Gender	Man	-0.414 (0.485)	-0.103 (0.162)	-0.842 (0.161)
Socio-professional origin	At least one parent is a farmer or equivalent	0.616 (0.513)	0.052 (0.201)	0.025 (0.200)
Training programme	Production and processing	-2.097 ** (0.830)	-0.214 (0.305)	-0.143 (0.315)
	Protection of nature	-0.666 (1.050)	0.539* (0.303)	0.538* (0.308)
Spatial location of the school	Rural	1.838** (0.659)	-0.001 (0.206)	-0.040 (0.205)
	Urban	0.757 (0.644)	---	---
	Peri-urban	---	-0.088 (0.214)	-0.045 (0.218)
Information sources often or very often used	Social media	-0.734 (0.698)	0.328 (0.269)	0.354 (0.267)
	School (teacher and/or class) (1)	1.779*** (0.578)	0.615** (0.273)	0.500* (0.271)
	Newspapers	1.611*** (0.529)	0.492** (0.173)	0.402** (0.176)
	TV	-0.119 (0.650)	-0.095 (0.221)	-0.081 (0.220)
	Family and friends	-0.360 (0.644)	0.190 (0.207)	0.213 (0.207)
Trust in information	Social media	-0.380	-0.156	-0.134

sources		(0.538)	(0.182)	(0.181)
	School (teacher and/or class) ³	1.455 (0.957)	-0.071 (0.484)	-0.136 (0.495)
	Newspapers	-1.541 (1.0.8) [sic]	0.270 (0.292)	-0.352 (0.291)
	TV	0.726 (0.559)	-0.446* (0.223)	-0.495** (0.223)
	Family and friends	-0.561 (0.734)	-0.415 (0.301)	-0.399 (0.299)
	Constant	1.122(1.253)	1.329** (0.470)	0.994* (0.524)

Source : Authors

Legend: Significance of the variables: * significant at the 10% threshold; ** significant at the 5% threshold

From this table, it appears that students' level of awareness of climate change is unrelated to gender and socio-professional background. The table also reveals that the training programme variable is strongly linked to the level of student awareness of this issue. This awareness is much lower in training programmes preparing for production careers than in the ones preparing for careers in the development and protection of natural environments. Students in these latter subjects are the most willing to revise their beliefs (Model 1) and the most likely to express their intention to change their daily practices in order to combat climate change (Model 2 results). Indeed, the results show that students who are in training programmes preparing for production trades have a lower likelihood of expressing awareness of climate change. On the other hand, training for careers in the development and protection of natural environments has a positive impact on the revision of student practices.

³ As the data for the teacher and class information source variables were strongly correlated, they were grouped in a "school" variable equal to 1 if the student regularly seeks information from either the teacher or the class.

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3 The spatial location of the schools was also found to be significant variable of students'
4 greater or lesser awareness of climate change. Thus, students from schools located in urban (as
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The spatial location of the schools was also found to be significant variable of students' greater or lesser awareness of climate change. Thus, students from schools located in urban (as opposed to rural) territories have a significantly lower level of awareness than students from schools located in rural areas and inversely. This result shows that the location of the training facility is not neutral in students' perceptions of climate change.

When it comes to privileged sources of information, there were several noteworthy results. First, the information from the family circle was of little significance. Clearly, this means that belonging to other cultural spaces contributes more to the formation and transformation of young people's beliefs about climate change. Second, it appears that school and social media have highly contrasting effects on student beliefs and on the actualisation of their practices. Although these two cultural spaces are important vectors of information for young people, as showed above, they do not have the same impact. In fact, whereas students regularly turn to social media for information, this information source is not a significant variable in our Models 1 and 2 to explain changes in both beliefs and practices. On the other hand, school appears to be a highly significant variable of these changes. Third, the information conveyed by newspapers also appears to be a non-negligible vector of these same changes. The control variables relating to the level of confidence in each of the knowledge sources do not appear to be significant in any of the models, either.

Lastly, Model 3 reveals a strong correlation between level of climate change awareness and actualisation of practices. The number of changes in habits among students increases very significantly with the importance they place on climate change.

In the next section, these results are completed with a more qualitative analysis of the interviews to better understand the knowledge transmission process and more specifically the particular role assumed by students as intermediaries in this process.

4.3. Students' role as intermediaries

An in-depth analysis of the replies to the questionnaires in the context of semi-structured interviews with 12 students enabled us to reconstruct the students' relational chains for accessing knowledge. These relational chains give us information about the intermediation role (see 2.2) at school, in social media and in their territory of life. Table 5 below provides a summary of this analysis.

We can see that almost all of the twelve students interviewed assume a role as intermediaries in the spread of knowledge about climate change. However, this intermediation activity can be of varying intensity in the three cultural spaces under consideration and rely on different channels.

Table 5: Summary of relational chains

Identification number	Training programme and location	Location of the secondary school	Spread within the territory	Spread within agricultural education	Spread within social media	Intermediary role
150	MPN	Urban	<=>	<=>	<=>	+++
125	MPN	Urban	<=>	<=>	<=>	+++
15	MPN		=>	<=>	=>	0
180	MPN	Peri-urban	=>	=>	=>	++
122	MPN	Peri-urban	=>	<=>	0	+
91	MPN	Rural	<=>	<=>	0	++
12	MPN	Peri-urban	0	<=>	0	+

101	Other (horticultural AATD)	Urban	0	<=>	<=>	++
77	MPN	Urban	=>	0	<=>	+
19	PP	Rural	<==>	0	0	++
35	PP	Peri- urban	0	0	=>	+
145	MPN	Rural	<==>	0	<=>	++

Source : Authors

Legend: MPN: Management and protection of nature and PP: Production and processing. The arrows show how knowledge is spread in cultural spaces. The => sign means that the cultural space under consideration influences the young person's practices and the <=> sign means that the young person acts as an intermediary and spreads knowledge within this cultural space. The length of the line shows the importance the young person places on this cultural space. The last column summarises the number of + that qualifies the intensity of the intermediation provided by the student.

It appears that only two students (150 and 125) act as intermediaries between the three cultural spaces by mobilising the knowledge derived therefrom in a complementary manner. Two other students (122 and 91) play a strong intermediary role between their territory and school but without the use of social media. Other students, for example (15 and 180), use their presence in all three cultural spaces more to disseminate information and much less to inform themselves. Consistent with the previous results, agricultural education is a cultural space of reference for students. Such is the case for the six students already mentioned but also for two other students (101 and 12). Only five students said they did not use the information and knowledge that are spread in the school environment.

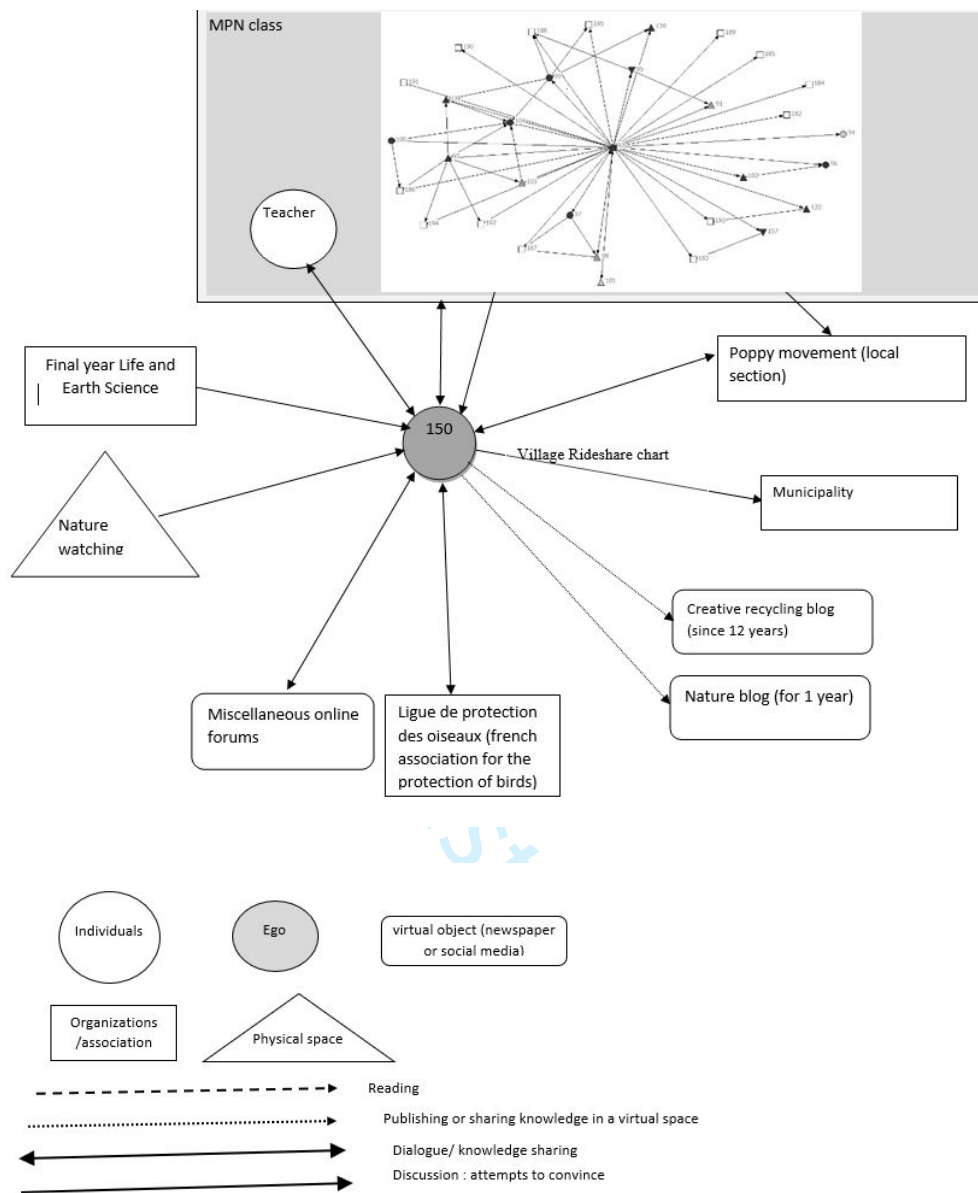
Social media and online media, on the other hand, are primarily used by students to spread their knowledge about climate change and influence their families and peers rather than as sources

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3 of their own knowledge. Lastly, the territories of life, particularly in rural areas, are cultural
4 spaces in which students shape their beliefs about climate change and then define rules of action
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7 to combat it.
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10 This analysis, conducted on the basis of the 12 interviews, provides us with an initial
11 characterisation of the intermediary role played by the students in their classes, in social media,
12 and also in their territories of life. To better understand this intermediary role, the ways in which
13 students access knowledge about climate change and how students then mobilise this
14 knowledge in their territories and in their classrooms is depicted. These depictions specify the
15 primary determinants of students' beliefs about climate change: discussions at school,
16 involvement in social media, specific observations of natural environments carried out in the
17 territories of life, etc. These depictions also include the types of action that students may have
18 taken at the local level to combat the effects of climate change. Below, two illustrations
19 accompanied by summary comments based on the statements collected are proposed.
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33 These two illustrations and Table 5 supplement the results of the econometric analysis which
34 showed that on average students living in a rural territory are more aware of the natural
35 environment than those living in an urban or peri-urban territory. They also reveal that the
36 characteristics of the territories of life are important elements to consider when understanding
37 students' beliefs about climate change. Rural territories, through direct observations of the
38 evolution of natural environments that they make possible, are indeed essential sources of
39 student knowledge about this phenomenon.
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49 **Figure 1: Schematic representation of student 150's role as an intermediary**
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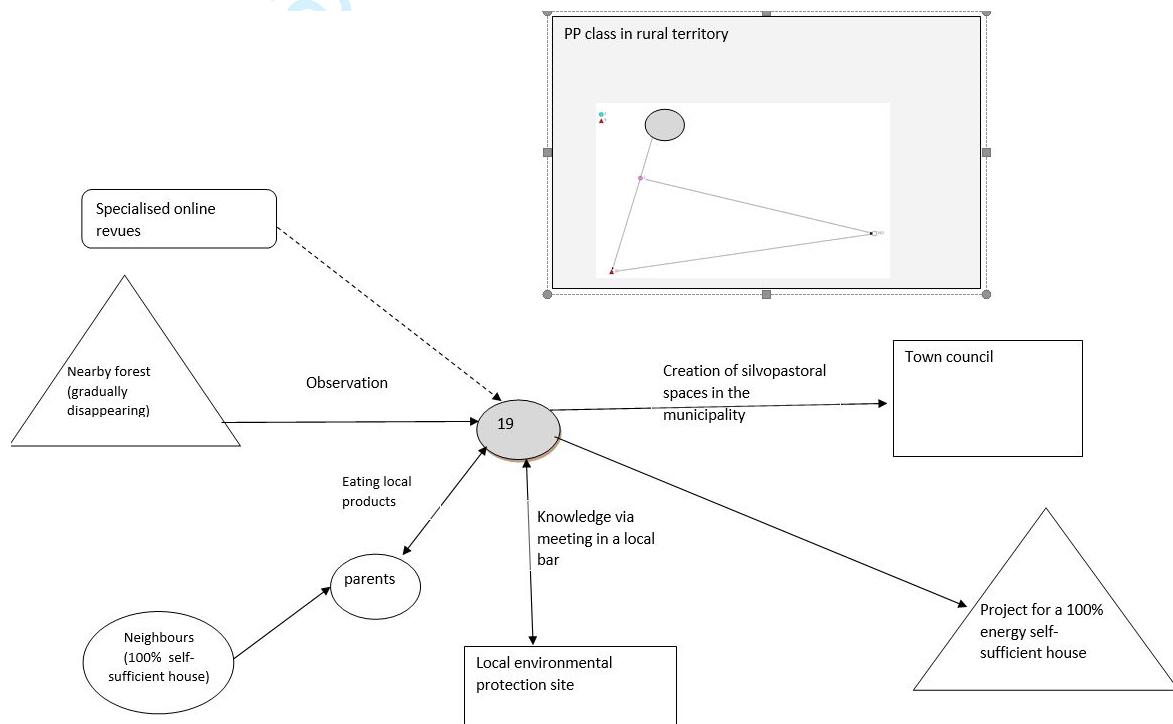


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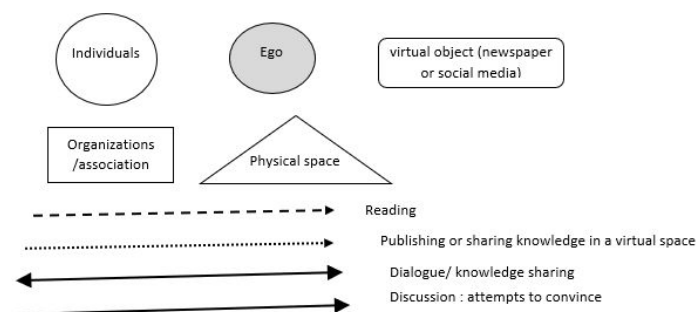
In figure 1, the student (150) in the MNP programme at an urban secondary school uses knowledge from the three cultural spaces. First, the territory of life is used as a preferred place to observe natural phenomena. He also very occasionally uses the information collected in different digital forums. Interactions in the school space and particularly those with another classmate (125) significantly influence his beliefs. Nevertheless, he is no less critical of the content taught on the topic of climate change. In his opinion, this content is not sufficiently action-oriented. This student's intermediation activity takes place through his involvement in

social media and local life. With regard to social media, he has created two blogs, one addressing creative recycling matters and the other focusing specifically on environmental protection (publishing nature photographs). With regard to his territory of life, this student is active in a local organisation (movement to prevent the use of pesticides on poppies). Sparked by discussions with one of his teachers, this involvement has led to very concrete actions such as the creation of a local carpooling initiative.

Figure 2: Schematic representation of student 19's role as an intermediary



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3 In figure 2, the student (19) in the PP programme at one rural secondary school uses the
4 information and knowledge that is spread at his school to shape his opinions on climate change.
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7 In particular, he places a great deal of trust in what his teachers say. However, since he is not
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10 very active in his class and on social media, he mainly exercises his power of action in his
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12 territory of life and with his immediate family members and friends. For this student, the
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14 territory is an essential place to observe threats to the natural environment and a place from
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16 which he deploys his action to confront them. Thus, the perception of the gradual disappearance
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18 of the local forest led him to get actively involved in a Tarn farmers' association which, with
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20 the assistance of the town council, advocates the recovery of the village's silvopastoral areas.
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22 This student also plans to invest in a project to build a 100% energy self-sufficient house and
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24 to develop a permaculture-based market gardening activity.
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31 **5. Discussion**

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33 In the following discussion, authors propose to firstly critically examining the original results
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35 obtained particularly concerning the role of the three cultural spaces at the hearth of the analysis.
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37 Then, they also propose to discuss their implications for designing training curricula integrating
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39 the theme of climate change. The question of the status of non-academic knowledge within
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41 these curricula will be central to this discussion.
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47 **5.1. Critical review of results about the place of three forms of culture: social media, school 48 and territories**

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50 Three original findings relative to the three observed cultural special are worth highlighting and
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52 discussing.
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55 First, the results in the survey had shown the a priori paradoxical place of digital culture,
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57 although students use social media to inform themselves about climate change, they don't have
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59 trust into the information transmits through these media. Social media plays also a negligible
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3 role in restructuring students' beliefs. Then, the interviews give us more information about this
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5 apparent paradox. Indeed it is primarily to spread knowledge about climate change and much
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7 less to learn about it them. They use it first and foremost to influence the opinions of other
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9 actors. It would no doubt be appropriate to further analyse and understand this position of
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11 students towards social media. In the interviews, the level of trust in information from social
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13 media seems to be one explanatory factor. Thus, while praising the fluidity and spontaneity of
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15 the discussions that take place therein, the students repeatedly expressed their deep mistrust of
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17 information from social media. Nevertheless, the credit granted to this information seems to
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19 increase with the reputational level of the persons who disseminate it: prominent representatives
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21 of civil society such as Pierre Rabhi (2014) who are deeply committed to defending the
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23 environmental cause.

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28 Second, the econometric results shows the role of rural space for explain the importance of
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30 believe in climate change: students from rural territories give a larger importance on climate
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32 change than urban one. Then, the qualitative analyse and the two case studies could help to
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34 explain this result. Territories also provide cultural and institutional frameworks conducive to
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36 the deployment of individual and collective action. Thus, the territory, specifically in rural
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38 areas, appears as a space for innovation because it is potentially the source of new rules and
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40 norms of behaviour. Even though, as various students pointed out, the characteristics of rural
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42 life, especially the remoteness of access to various private and public services, could hinder the
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44 adoption of certain pro-environmental practices, the importance of close ties between actors
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46 within the rural territories facilitates participation in actions to defend the natural environment.
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48 Accordingly, several students pointed out that the high level of social capital in these
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50 communities represented a genuine opportunity to promote new practices such as carpooling or
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52 waste sorting. Therefore, while our results revealed that the students surveyed play an
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54 intermediary role in the three cultural spaces under consideration, it is clearly within the
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3 territories of life, and mainly the rural territories, that they can most actively play this role and
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5 emerge as real agents of institutional change. However, our analyzes should be further
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7 developed by examining more precisely the place and roles of students in the creation and
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9 coordination of local collective structures acting for the defence of the climate.
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12 Third, school and particularly teachers are a major source of knowledge about climate change
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14 for students, and moreover students give a large trust on these source of knowledge and
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16 particularly for nature protection specialisation studies. Moreover the interviews show that the
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18 student disseminate knowledge acquired at school through social media, into social sphere and
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20 in their territories. Indeed, school, in this case agricultural schools, is a space for interactive
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22 discussions in which opinions on climate change are formed and transformed. The educational
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24 methods used in agricultural schools, which rely on project-based and investigative teaching
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26 approaches, undoubtedly stimulate the debate. This debate is not fuelled so much by academic
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28 knowledge (climate change is still not widely taught) as it is by the life experiences of the
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30 various actors in the school system: students and teachers. Even more than the former, the latter
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32 are very often individually involved in actions to combat climate change (use of soft transport
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34 modes, practice of composting, etc.). It is also these teachers who suggest newspaper articles
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36 to the students so they can learn about climate change. Such articles were shown to have a
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38 significant impact on beliefs but also practices against climate change in the same time than
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40 teachers themselves. Furthermore, the solid local anchorage of agricultural schools lends them
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42 the necessary legitimacy to play a role in territorial intermediation on the issue of climate
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44 change. In particular, they can rely on their farm “annexes” for this purpose (DGER and IAE,
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46 2022). Used for educational purposes, these farms have historically been centres for
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48 experimentation and innovation in new agricultural practices, and in this respect, they are also
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50 centres for the invention of other possible worlds. As a corollary, these results raise the essential
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52 question of the place to be given to non-academic knowledge in training curricula. Indeed, as
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3 described in this article, students are led to live singular experiences and to acquire and produce
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5 knowledge about climate change in cultural spaces other than the school.
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10 **5.2 What place for non-academic knowledge in curricula?**

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12 This questioning of the role of non-academic knowledge in the learning process has its origins
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14 in the thinking that began in the 1970s with the new sociology of education and curriculum
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16 (Young, 1972; Apple and Apple, 2004). As Young (2008) explains, these authors challenged
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18 the traditional separation between academic and non-academic knowledge. In the name of the
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20 search for more democratic forms of curricula and more inclusive, participatory learning
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22 processes, they challenged the idea of a structural differentiation between domains of
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24 knowledge (scientific versus contextual). The complementarity of these two domains could
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26 then be apprehended as a vector for the production of new knowledge. In the case of
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28 environmental education, and more specifically climate change education in this case, this
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30 complementarity may be all the more well-founded given that, as Lebeaume (2015, p.26) points
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32 out, that education to a specific subject (“education à”) are not specifically about knowledge in
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34 the strict sense, but also about ethical or political values and behaviours.
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40 But does this mean that both types of knowledge are equally valuable for learning? For Young
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42 (2008), who recently took a critical look at his earlier work, the answer is negative. According
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44 to this author, while contextual knowledge provides individuals with cognitive resources for
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46 adapting to the world, it deals only with the particularities of everyday life. This distinguishes
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48 it from disciplinary or specialized knowledge, whose scope goes beyond the simple context of
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50 application. Young describes the latter as "powerful knowledge", in the sense that it confers on
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52 its possessor the intellectual power to rethink the world and engage in political and moral
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54 debates. By following Young (2008), the value of equipping students with powerful knowledge
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56 in climate change education is underlined. Indeed, while non-academic knowledge can be used
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3 to support the mastery of conceptual knowledge, it alone cannot be sufficient to develop a
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5 school program around the issue of climate change.
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8 In fact, while non-academic knowledge can be used to support the mastery of conceptual
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10 knowledge, it alone cannot be sufficient to develop a school program around the issue of climate
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12 change. In the end, Young's proposal (2008, p. 15) seems to us to sum up the challenge of
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14 mobilizing in the classroom the experiences and knowledge about climate change acquired by
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16 pupils in cultural spaces other than school. It goes without saying, however, that moving in this
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18 direction requires the identification of a body of scientific knowledge that is available and
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20 sufficiently robust to achieve the status of powerful knowledge in curricula. This is no easy
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22 task, given the ongoing controversy surrounding climate change.
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28 **6. Conclusion**

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30 The purpose of our study was to reveal the main sources of knowledge about climate change
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32 for AATD students at French agricultural schools and to better understand how the spread of
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34 knowledge about this topic took place in three cultural spaces: school, social media and the
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36 territories of life. At the same time, it examined the extent to which this spread shapes students'
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38 beliefs and empowers them to act. Our results confirm those of previous studies (Corner et al.,
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40 2015, Lee et al., 2020) showing that young people, in this case students trained in French
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42 agricultural education, tend to be sensitive to climate change issues and act to combat it.
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47 Beyond that, they reveal that social media, schools and territories of life are, to varying degrees,
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49 spaces for negotiating/renegotiating the cultural meanings relating to climate change. This
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51 negotiation/renegotiation process is the result of a dialectical movement between culture (what
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53 is possible) and institutions (what is canonical) which, in fine, determines the capacity of this
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55 young population to actualise its ways of thinking and acting.
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3 Among the three cultural spaces at the heart of our investigations, the school is destined to play
4 a major role as a vector for changing behaviours and empowering young people. Indeed, it's
5 mainly within schools that powerful knowledge is transmitted. This context-independent
6 knowledge enables us to go beyond particularities, and therefore beyond experience (Young,
7 2008). Equipping students with such powerful knowledge of climate change, however, requires
8 a profound reform of curricula. This means transposing new conceptual frameworks derived
9 from research into school curricula. In addition, it is important to support teachers' mastery of
10 these new concepts. In our view, strengthening the links between research and training, in
11 particular through the implementation of collaborative research approaches, is one way of
12 meeting this last challenge and contributing to the institutionalization of new knowledge on
13 climate change in curricula.
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Table 1: Description of the survey group

Location of the secondary school	Agricultural production programme		Management and protection of nature programme		Other programmes		Overall total	
	number replies	number surveyed	number replies	number surveyed	number replies	number surveyed	number replies	number surveyed
Secondary school in rural territory	17	23	39	66	11	16	67	105
Secondary school in peri-urban territory	19	26	44	58	0	0	63	84
Secondary school in urban territory	39	68	18	32	7	7	64	107
Overall total	75	117	101	156	18	23	194	296

Source :authors

Table 2: Importance placed on climate change

Importance placed on climate change	Number of students	%
1-not important	1	0%
2-moderately important	3	2%
3-important	25	13%
4-quite important	63	32%
5-very important	102	53%

Source: Authors

Table 3: Student information sources and positioning with regard to these sources

Knowledge source	Extent to which this knowledge source is used	Total	%	Number of students according trust in the knowledge sources (%)
Social media	0-never or 1-rarely	26	13%	78 (40%)
	2-sometimes	31	16%	
	3-often or 4 -all the time	137	71%	
Teachers	0/1	32	17%	185 (95%)
	2	48	25%	
	3/4	114	58%	
Family and friends	0/1	34	18%	167 (86%)
	2	74	38%	
	3/4	86	44%	
Newspapers	0/1	47	24%	170 (88%)
	2	64	33%	
	3/4	83	43%	
TV	0/1	48	25%	126 (65%)
	2	62	32%	
	3/4	84	43%	
Class	0/1	55	28%	162 (83%)
	2	67	35%	
	3/4	72	37%	
Influencers	0/1	118	61%	125 (64%)
	2	48	25%	
	3/4	28	14%	
Radio	0/1	104	54%	147 (76%)
	2	63	32%	
	3	27	14%	
Politicians	0/1	122	63%	77 (40%)
	2	57	29%	

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	3/4	25	13%	
	Total	194	100%	

Source: Authors

Table 4: Factors explaining climate change awareness and revised practices

Variables		Model 1	Model 2	Model 2
	Number of habits changed (0-5)		Variable explained	Variable explained
	Importance placed on climate change	Variable explained		0.493** (0.205)
Gender	Man	-0.414 (0.485)	-0.103 (0.162)	-0.842 (0.161)
Socio-professional origin	At least one parent is a farmer or equivalent	0.616 (0.513)	0.052 (0.201)	0.025 (0.200)
Training programme	Production and processing	-2.097 ** (0.830)	-0.214 (0.305)	-0.143 (0.315)
	Protection of nature	-0.666 (1.050)	0.539* (0.303)	0.538* (0.308)
Spatial location of the school	Rural	1.838** (0.659)	-0.001 (0.206)	-0.040 (0.205)
	Urban	0.757 (0.644)	---	----
	Peri-urban	---	-0.088 (0.214)	-0.045 (0.218)
Information sources often or very often used	Social media	-0.734 (0.698)	0.328 (0.269)	0.354 (0.267)
	School (teacher and/or class) (1)	1.779*** (0.578)	0.615** (0.273)	0.500* (0.271)
	Newspapers	1.611*** (0.529)	0.492** (0.173)	0.402** (0.176)
	TV	-0.119 (0.650)	-0.095 (0.221)	-0.081 (0.220)
	Family and friends	-0.360	0.190	0.213

		(0.644)	(0.207)	(0.207)
Trust in information sources	Social media	-0.380 (0.538)	-0.156 (0.182)	-0.134 (0.181)
	School (teacher and/or class) ¹	1.455 (0.957)	-0.071 (0.484)	-0.136 (0.495)
	Newspapers	-1.541 (1.0.8) [sic]	0.270 (0.292)	-0.352 (0.291)
	TV	0.726 (0.559)	-0.446* (0.223)	-0.495** (0.223)
	Family and friends	-0.561 (0.734)	-0.415 (0.301)	-0.399 (0.299)
	Constant	1.122(1.253)	1.329** (0.470)	0.994* (0.524)

Source : Authors

Legend: Significance of the variables: * significant at the 10% threshold; ** significant at the 5% threshold

¹ As the data for the teacher and class information source variables were strongly correlated, they were grouped in a “school” variable equal to 1 if the student regularly seeks information from either the teacher or the class.

Table 5: Summary of relational chains

Identification number	Training programme and location	Location of the secondary school	Spread within the territory	Spread within agricultural education	Spread within social media	Intermediary role
150	MPN	Urban	<=>	<=>	<=>	+++
125	MPN	Urban	<=>	<=>	<=>	+++
15	MPN		=>	<=>	=>	0
180	MPN	Peri-urban	=>	=>	=>	++
122	MPN	Peri-urban	=>	<=>	0	+
91	MPN	Rural	<=>	<=>	0	++
12	MPN	Peri-urban	0	<=>	0	+
101	Other (horticultural AATD)	Urban	0	<=>	<=>	++
77	MPN	Urban	=>	0	<=>	+
19	PP	Rural	<=>	0	0	++
35	PP	Peri-urban	0	0	=>	+
145	MPN	Rural	<=>	0	<=>	++

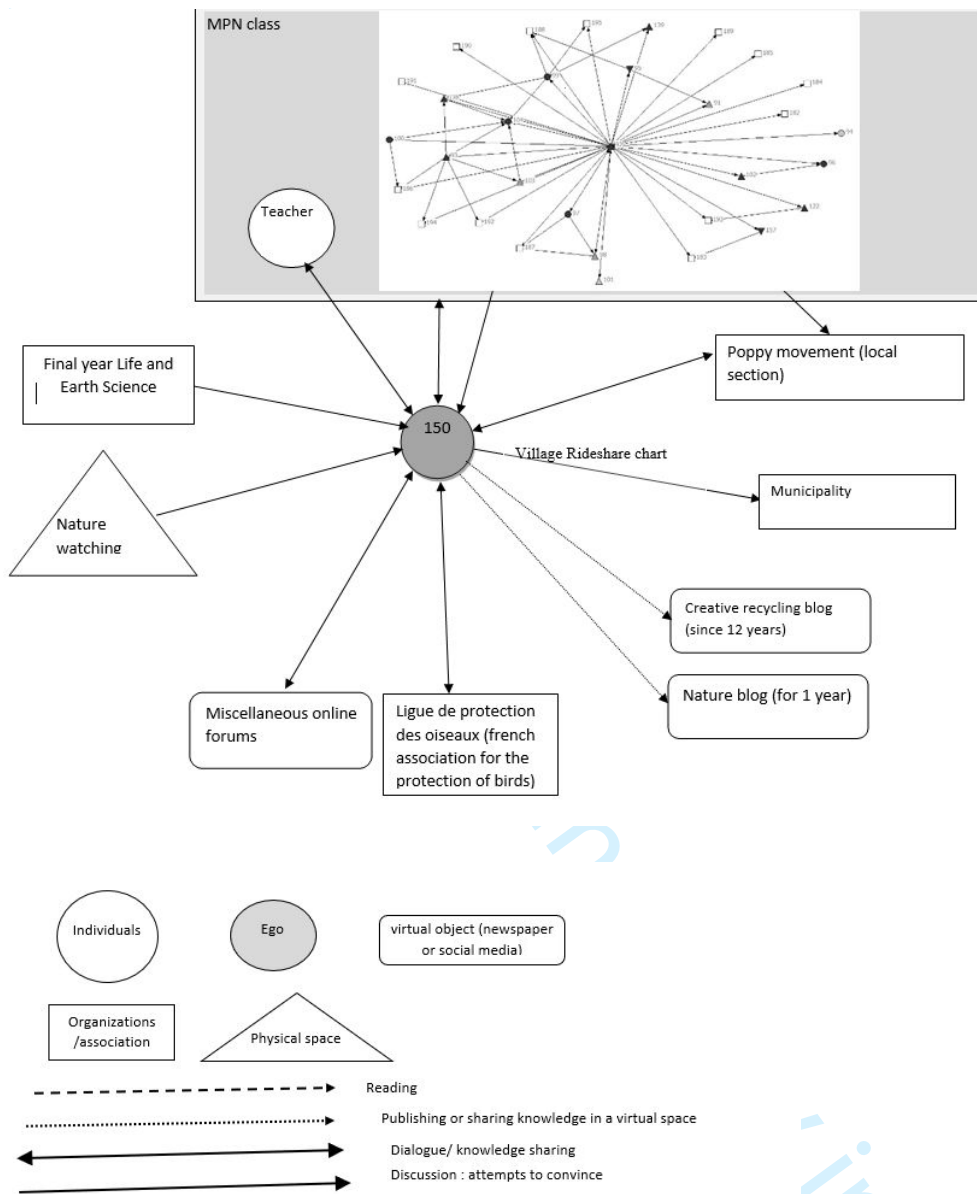
Source : Authors

Legend: MPN: Management and protection of nature and PP: Production and processing. The arrows show how knowledge is spread in cultural spaces. The => sign means that the cultural space under consideration influences the young person's practices and the <=> sign means that the young person acts as an intermediary and spreads knowledge within this cultural space. The length of the line shows the importance the young person places on this

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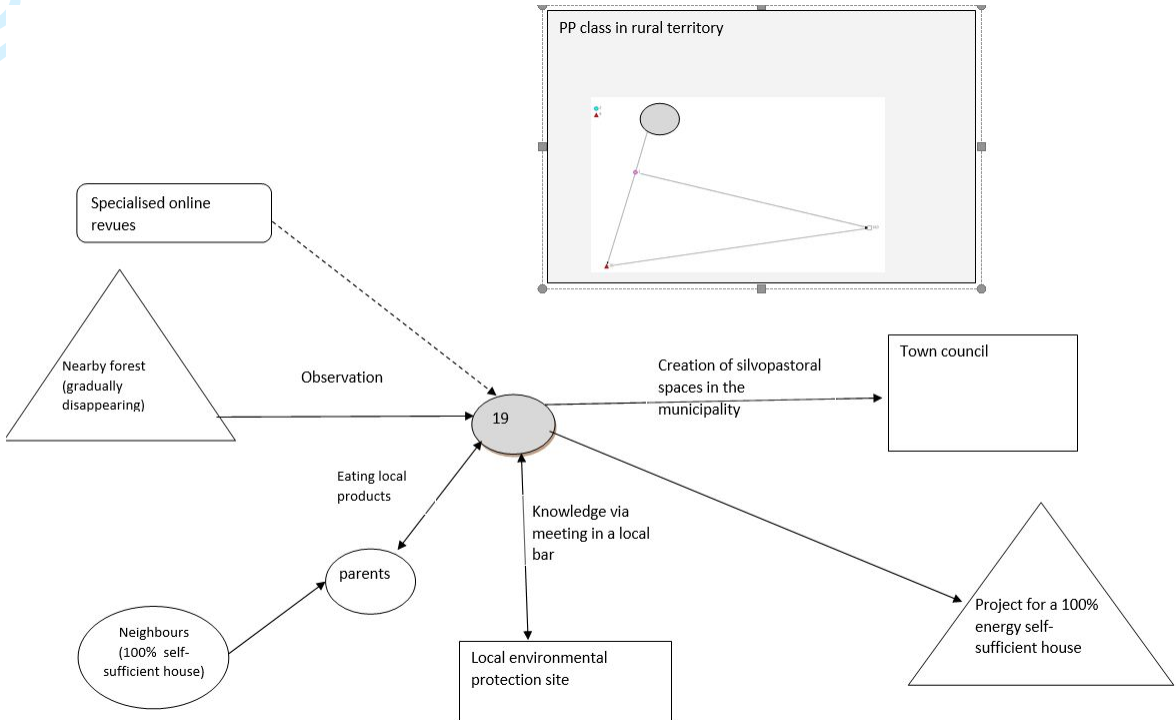
cultural space. The last column summarises the number of + that qualifies the intensity of the intermediation provided by the student.

Figure 1: Schematic representation of student 150's role as an intermediary



Key:

Figure 2: Schematic representation of student 19's role as an intermediary



Key:

